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ABSTRACT

This discussion identifies some of the social and organizational issues which will affect the design and implementation of a university management information system (MIS). Implications are discussed which affect both the data collection, and analysis and reporting segments of the MIS process. The analysis points out the extent to which an MIS design needs to consider the nature of the university in which it is placed, and some of the critical problems for implementing and gaining acceptance and utilization of MIS. Some of the difficult issues and organizational questions with which a university's executive officers and the MIS director must struggle to implement an effective total management information system are discussed. A 26-item bibliography is included. (MJM)

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Some Organizational Implications of a Management Information System

by

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This Chapter by Dr. Peterson, an Associate Professor at Michigan's Center for the Study of Higher Education, will appear in a forthcoming book on Management Information Systems. It is presented here for information, rather than citation purposes

Introduction

In his book, The New Utopians, Robert Boguslaw is concerned that the social engineers of our times, the systems engineer, the operations researcher, the computer and/or data systems specialists, have utilized social theory only in "after-the-physical-fact"[1] kinds of analysis. They assume a position of aloofness to human and social problems and see "human error" as a threat to the rational systems that they devise. Such an approach leads to the construction of models or systems which utilize "hard" data, require computerized or automated hardware, and stress the internal logic of their creation without *a priori* consideration of the variability of the human and social context in which the devices must operate or the potential impact they may have.

It is a similar ideological concern that motivates this paper; the concern that most management information systems designers on the current higher educational scene are only marginally interested in or knowledgeable about social and organizational theory which might help them devise more workable systems. The technology to build large-scale management information systems is available, and despite its expense, is being developed at Toronto, Michigan State University, The University of Colorado, on a larger scale by the Western Interstate Commission on Higher Education, as well as other places. Yet little of the literature describing the new systems speaks to the issues raised by the social and organizational context of the colleges and universities in which they are to operate. Thus, the major purpose of this discussion is to identify some of the social and organizational issues which will affect the design and implementation of a university management information system in a college or university setting.

I.

IDEAL GOALS FOR MIS

A management information system serves basically a managerial function for a university or any other organization which institutes one. It is not, however, the purpose of this paper to justify the need for one. Such an assessment has to be made by each college or university; however, the pressures for such a system are widely discussed and relatively obvious: the external demands for information on university activities, the financial pressures to utilize resources effectively, the tendency to make decisions more openly in the university which requires more and better information if those decisions are to retain a rational rather than political focus, and many others.

Beyond the broadscale need for an improved MIS however, one can identify specific goals which a successfully devised and implemented system should serve a university. First, the data items in the information system should be defined consistently for use across informational subsystems, the subsystems should be integrated to insure that analyses which require data from two or more subsystems (as in evaluation of cost per student credit hour - course credits and faculty salaries) can be easily obtained, and the data should be accurate to some high degree. All aspects of this goal must be achieved if the information is to be maximally useful and is to have a high level of user confidence. Second, the MIS needs to be related to the university's (or some segment's) information needs, goals, and/or decision making processes. Only then will the MIS be able to directly contribute the

university's managerial, boundary relations, and productive functions. Third an MIS must be flexible. It must not be a constraint on the university's capacity to adapt to pressures for growth, reshuffling of priorities, revising of academic programs, and the like. In today's turbulent university environment adaptability is a key function which an information system can and should serve. Finally, an information system to be fully effective has to be devised, implemented, and operated in such a fashion as to insure that the system is viewed as legitimate (not just accurate) and is utilized. This is no small goal in an organization such as the university in which students are suspicious of administrators, faculty resist being quantified and analyzed, and administrators are subject to external pressures for decisions that are politically expedient rather than ones that are internally justified. In this sense the information system is being asked to serve a maintenance function; i.e., to assure that it is a mechanism which enhances the trust of university faculty, students, and administrators rather than one which alienates them from each other.

It should be evident that this conception of goals for a management information system is directed at a comprehensive data base that assists the university in dealing with both internal and external problems. It serves all the basic functions of an organization, i.e., productive, managerial, maintenance, boundary, and adaptive,[2] although it is primarily a management tool. Further, the first of the four goals can be achieved for the most part, by the technical specialist; by the operations researcher, the systems analyst, and the computer expert. The latter three goals, however, depend on the "fit" of this new technological system with the existing formal and social organizational system. It is the issues that

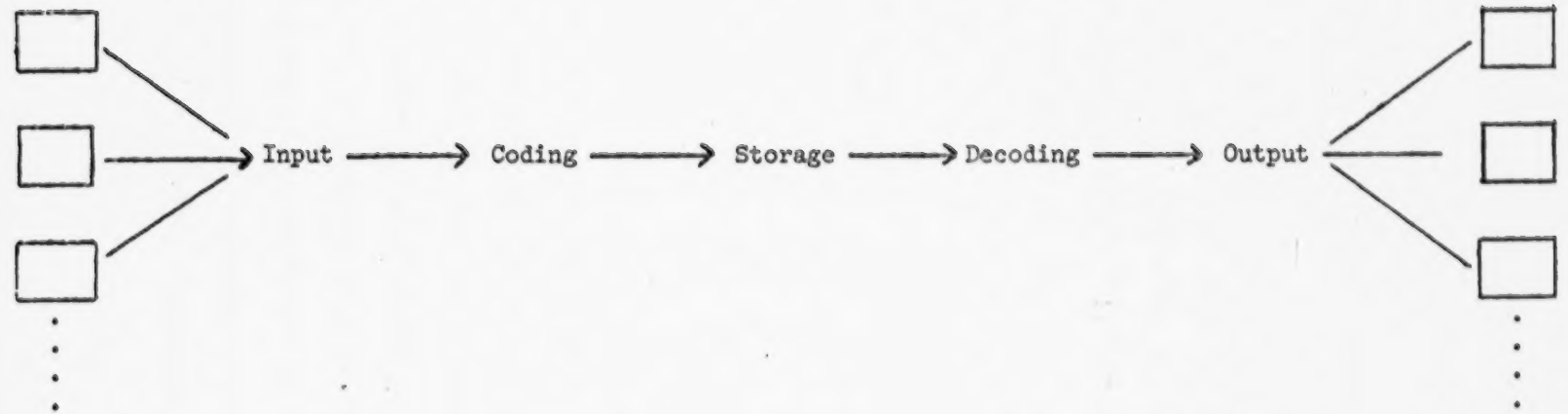
arise in this fit or interface between the new technology and the other two systems which constitute the primary analytical focus and organization of what follows:

A. A University MIS: Some Basic Assumptions

In designing a management information system with such comprehensive goals for a complex university, there are several basic and perhaps obvious assumptions that need to be stated. First, to handle a data base for a large institution, it must be assumed that the hardware will be an integrated computer system rather than some other mode of data processing. At least that is the nature of the hardware system to be evaluated. No doubt there will be some components of the data system which are small in size or rarely used for which another mode of data storage and handling might be appropriate and less expensive. Second, an MIS is conceived to be a highly developed information and reporting system which includes data collection, coding, storage, retrieval and/or analysis, and reporting to users. The following diagram may clarify the information processing components. (See Chart I).[3] The important point is that the conception of an MIS encompasses a concern for data collection and reporting of data as well as an internal system of data and computer hardware and software. This interface between the rest of the organization and the MIS system has to be designed as carefully as the internal logic of the models, programs, and/or simulations that make up the computer based coding, storage, and decoding elements of the system. A third assumption stemming directly from the second is that any reference to MIS in this discussion, unless otherwise noted, will refer to the computer system, the information processing capability, and the entire staff necessary to support a system as exemplified in Chart I. The internal logic of the data files, hardware, and staff

CHART I

The MIS Process



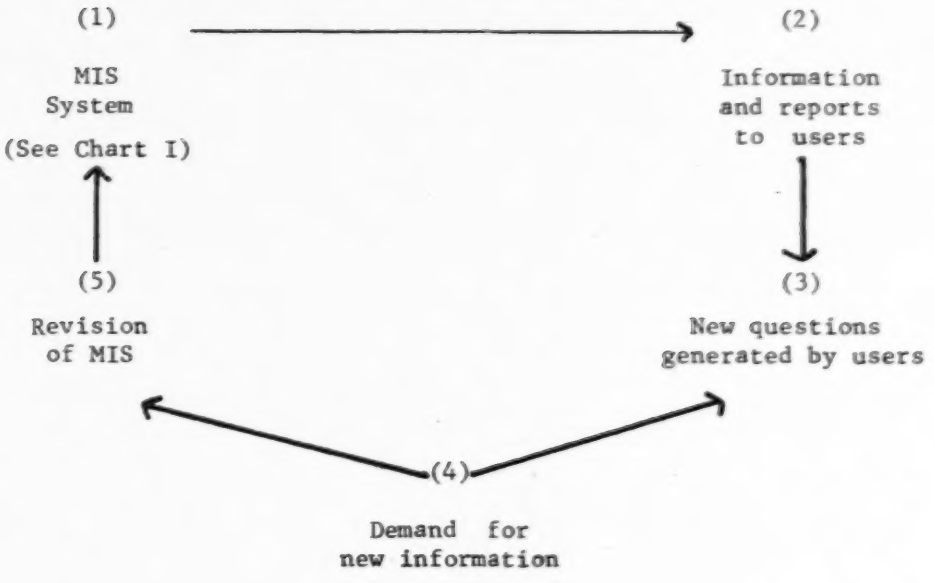
Data Sources	Data elements	Standard data definitions; files and data subsets	Manual or automated hardware memory systems	Data retrieval and/or analysis of data	Reporting formats and delivery system	Data users

organization of the MIS systems is not analyzed directly.

A final assumption, related to the goal of flexibility, is that the MIS system is potentially self-generating (see Chart II). Not only will

Chart II

The Self Generating Character of MIS



information appropriately analyzed and reported answer the users needs, but that information itself may highlight new problems or stimulate questions which require modification of the MIS system's data inputs, methods of storage, and/or reporting formats. For example, reports of faculty workload to department chairmen may not only help him allocate it more equitably among his faculty but may stimulate such questions as: How does this compare to other similar departments in the University (a revision of reporting format?) or, How does this compare to departments of our type in other comparable universities (new data input required?) or, What are faculty members' actual activities

and how is this affected by workload assignments (new data of different type and new analysis and reporting format required)? What this assumption highlights is that demands for new information are not merely the product of new problems, decisions, or demands facing the user but that the information he receives has impact on the questions he will ask. Thus, MIS flexibility is a necessary goal because of its own impact as well as the changing nature of the university environment it services.

B. A University MIS: The Basic Design Questions

Having identified some idealized goals and the basic assumptions about the nature of MIS in a large university system, one can identify the key administrative questions which affect the nature of the design of the decision to implement a university management information system. They are:

1. What is the relationship of MIS to the larger university system?
2. What is the data content of the information system?
3. What is the content, format, and structure of the reporting system?
4. What are the technical capacities and internal organization of the MIS?
5. What is the cost of MIS? What are its benefits?

The remainder of this discussion is devoted essentially to providing an approach to answering the first three questions. The answers themselves will depend on each institution's self analysis as there is no unique answer or system that yet serves all institutions' needs, contexts, and resources. Questions four and five will be discussed by other authors. After briefly

describing the university as an organizational system, the interface of MIS and the formal and social organizational subsystems provides a framework for answering questions one through three.

II.

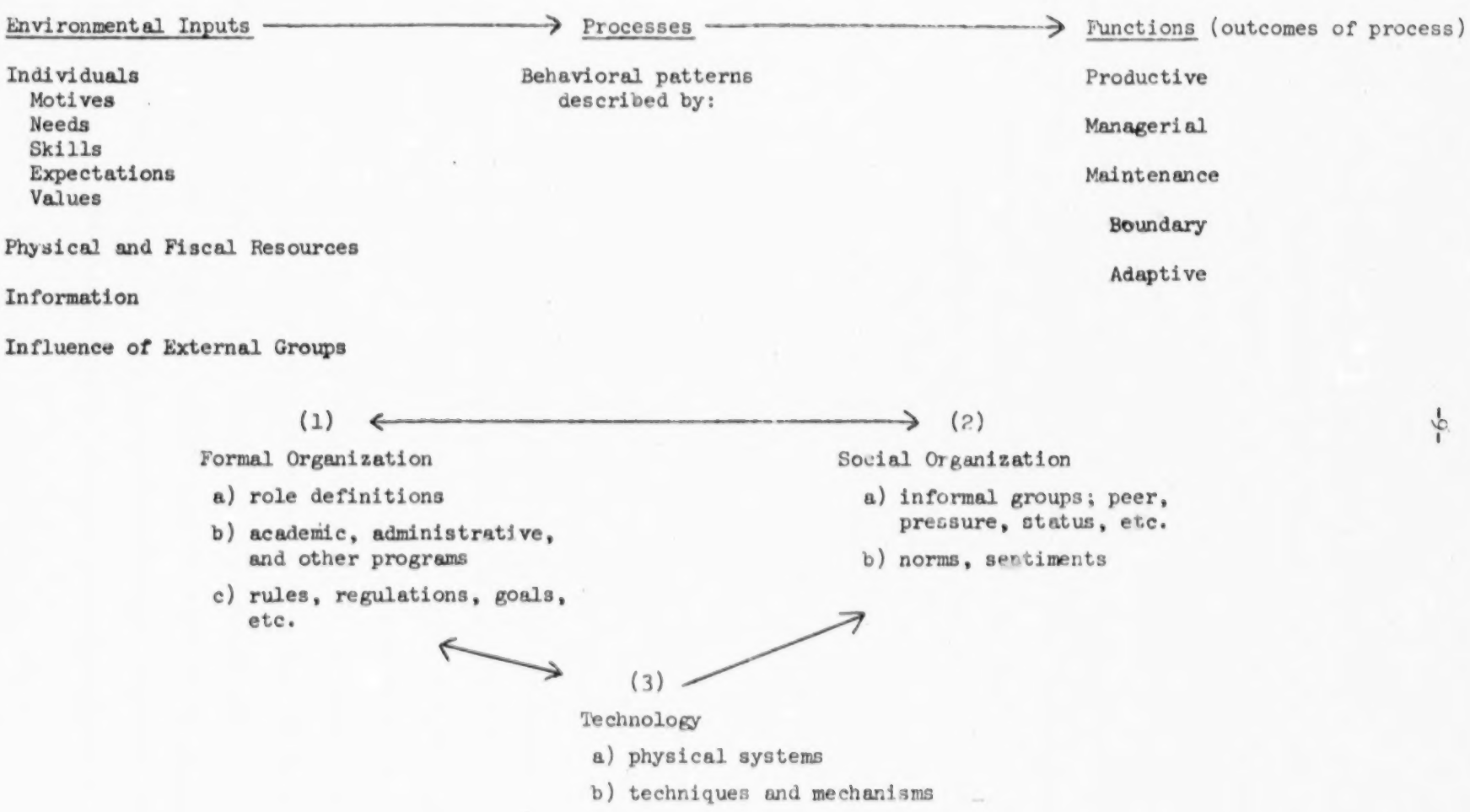
THE UNIVERSITY AS AN ORGANIZATIONAL SYSTEM

A university more than most societal organizations is a human organization, its products, processes, and raw materials are primarily people. However, in a setting as large and diverse as a complex university it becomes impossible to analyze it at the individual level, as a large conglomerate of people. Rather, the need is to identify the regular patterns of behavior (processes) and the regular relationships of positions and processes (structure) that enable the university to function as an organized entity which accomplishes certain purposes without destroying itself. This basic definition still views the university as a human organization and yet allows us to discuss the relationship of an MIS to it. Chart III suggests the context within which the university may be viewed as an organization.

It is neither possible nor necessary to capture all the complexity of a large multipurpose university in this brief space, but the diagram intends to capture the open, dynamic, and flexible state of the university as an organization. The activities and interactions of students, faculty, staff, and administrators constitute basic patterns of behavior that describe the universities varying processes--teaching, research, admissions, placement, decision making, communication, conflict resolution, etc. The processes themselves, lead to certain functional (or dysfunctional outcomes) outcomes

Chart III

The Organizational System



consisting of producing degrees, research, etc. (productive; allocating resources, evaluating effectiveness, etc. (managerial); limiting the stress on or providing rewards to human beings (maintenance); maintaining external relations (boundary); and adapting to new realities or planning (adaptive). These processes and their functional results are determined in part by the human, physical, and informational resources the university obtains from its environment and by the influence of external power groups and organizations. Further, the processes themselves can be defined in terms of their formal, social, and technological organization or subsystem.[4] One principle advantage of this scheme is that it can be utilized to analyze varied system levels whether it be a position such as the dean's office, a department, a college, or the entire university.

In this latter sense the formal organization is the formally approved set of positions, committees, and programs (the organization chart) and the goals, policies, rules, and regulations by which they are related. All of these act to control the pattern of individual's behavior, the requisite skills for various positions, and patterns of interactions with other persons whether they are students, faculty or administrators. The social organization refers to the informal groups of people that form in any organization or university based on their personal needs, motives, expectations, values, and interests. These groups often develop attitudes toward their work (sentiments) and/or patterns of behavior (norms) that may or may not be consistent with the patterns required by the formal organization. Finally, the technology of an organization refers to the physical mechanisms and techniques utilized. In a university the kinds of teaching resource materials, the kind of budget format, or the mode of information handling are examples.

All three of these subsystems, the formal, social and technological, obviously are affected by the kinds of inputs the university receives and, in turn, they affect the way people behave and the manner in which the processes (behavioral patterns) contribute to functional outcomes. What is less obvious, but widely recognized by social and organization theorists, is that changing any of the three subsystems is likely to affect the other. An integrated, computer-based MIS represents a substantial change in the university's technological system. It is the resultant impact of this technical subsystem change on the university's formal and social organizational subsystem and on the university's relationship with its external environment or resource-input relationships that constitutes the remainder of this paper.

III.

THE MIS - FORMAL ORGANIZATION INTERFACE

The nature of a university as a formal organization is embodied in the definition of a formal organization which is generally accepted by most organizational theorists; namely it is a "group of individuals (positions, behaviors or other units) with a characteristic structure who are banned together to achieve some specified purposes(s)." Thus, the notion of goals or purposes, structure, and the achievement of purpose or effectiveness are alements of the university as formal organization which will be reviewed in terms of their relationship to MIS. One further element, the decisionmaking process which describes the pattern of behavior by which an organization's members decide how to achieve their purposes, is also included.

A. The Problem of Goals

It is trite and stereotypic to note that goals are extremely difficult to define for a college or university, yet a more detailed analysis can lead to suggestions through which the notion of organizational goals (purposes or objectives) can be a useful guideline for development of an MIS. It should be obvious that the assessment of goal achievement requires an MIS which incorporates data elements which relate to a goal's content and a reporting format that allows assessment of its achievement. This analysis will not identify the specific goal content which should be generic to colleges or universities but rather the nature of goals which can be related to an MIS.[5]

For goals to be related to an MIS, they need to be "quantifiable"--to be subject to measurement. The level of measurement need not be highly accurate interval data, such as financial data, but may also be ordinal or categorical in nature. It can also be based on hard or soft measures (e.g., numbers of students vs. attitudes of students on an issue). The important point is that goals can be more accurately assessed if they are measured by more precise measurement scales and harder data. Needless to say, many colleges and universities avowed goals are not stated in a manner which permits measurement. For example "developing character" is not a measurable goal. However it can be redefined in terms of measurable attributes such as increasing "tolerance for other points of view" (a personality dimension) or "desire to take part in social service activities" (a behavioral or attitudinal measure).

Closely related to the "quantifiable/non-quantifiable" dimension of a goal is the "diffuse vs. specific" character of a goal. Providing "general education" may be diffuse whereas "general education for citizen involvement" is somewhat more specific (and quantifiable).

Another dimension of goals statements that causes difficulty in adapting them to an MIS assessment is the distinction of "ideal" vs. "operational" goals. One is quite aware that many liberal arts colleges which profess providing "character-building" or "general" education are in practice made up of deans, department chairmen, faculty (and even students) whose primary goal is to get the students into graduate school (academic and professional goals). Thus, defining an MIS's data elements and reporting system to relative to publicly stated ideal goals which are not congruent with the cumulative behavioral goals of the university community is to prepare a measurement system which is of questionable value or validity.

Again closely related to the previous concern is the point of view from which the "operational" (and hopefully ideal) goals are elicited. It is well known today that external constituencies such as the state legislature may define "campus peace" as the most important goal while students and faculty may be willing to tolerate some conflict for the sake of "desired change" and/or broader "learning experiences" as their desired goals. Such dilemmas are not easily resolved. However, an MIS probably needs to consider the goals of a variety of constituencies and collect appropriate data if information is to be a basis for rational discussions among opposing factions.

A final difficulty with the concept of goal in the university setting revolves around the "multiple" rather than "singular" nature of these organizations' goals. The teaching, research, and service goals in addition to being multiple are diffuse and often non-operational. Attempts to specify them and make them quantifiable leads to numerous subgoals. In fact, a study of University Goals and Academic Power by Gross and Grambsch identified

47 goals to be analyzed.[6] This multiple nature of university goals places an impossible burden on an MIS system if all possible goals are to be assessed. One possible solution is to think in terms of priorities among university goals so that the MIS data collection and reporting system can focus on those conceded to be most important at a particular time period. Another is to analyze goals of more distinct subunits of the university in which fewer goals may be identified.

The following summary (Chart IV) notes the relationship between the nature of goals and their relationship to a university MIS. It perhaps needs little elaboration to point out that an effective MIS requires considerable work by university decision making bodies to restate their goals in a mode which can be assessed and a considerable effort by the MIS designers to keep abreast of the nature and content of goals and the priorities among them.

Chart IV

Dimensions of Goals In Terms of Ease of MIS Assessment

Difficult to Assess	Easy to Assess
Non-quantifiable	Quantifiable (categorical, ordinal or internal; hard or soft)
Diffuse content	Specific content
Ideal	Operational
Non-organizationally defined	Organizationally defined
Multiple	Singular

B. Structure - The Goal Mediator

One mechanism for mediating the complex problem of relating university goals to an MIS system is to analyze the university structure at the level of its subunits. Here goals might be more singular, generally agreed upon, specific, and quantifiable. The difficulty arises when one seeks a basis for defining structure.

One approach is to define the university structure in terms of processess or their functional outcomes where structure is defined as the regular pattern among and between them. Thus, admissions, registration, teaching, research, service, placement, budgeting, etc., become the basic subunits of the university. The difficulty with this approach is that many of the processes may be carried on within the different educational units depending on the centralized or decentralized pattern of the university.

Another approach which fails to get at the functional outcomes of the university's activity is to define structure in terms of the pattern of its basic inputs: fiscal and physical resources, students, faculty, administrators, and staff. This provides a substantial data base but no framework for analyzing the processes and effectiveness of the university as it attempts to achieve its goals.

A third method is to define the university's structure in terms of the formal organization chart; i.e., its primary productive units such as the colleges and research and service units (and the appropriate subdivisions) and the support units such as student affairs, financial affairs, alumni, physical facilities, library, admissions and registration, etc.

This approach, which overlooks the possibility that there may be more effective structural arrangements, can insure a comprehensive coverage of data needs and allows information needs to be closely related to both the existing formal decision making structures. A thorough analysis of the basic primary and secondary units should highlight the data files and categories necessary to measure all the inputs, processes, and functional outcomes for each unit.

If one analyzes the basic productive units in terms of the model in Chart III several things become obvious. Within a college (or department), for example, it should be easier to identify the goals in a manner which are more compatible with developing MIS data elements and reporting schemes, i.e., there should be fewer goals which are more specific, quantifiable and operationally agreed upon. Further, it is possible to identify for each unit the inputs, processes, and outputs which are to be monitored by the MIS if assessment of goal achievement and subunit effectiveness are to be related to the types of decisions that the subunit must make. (Effectiveness and decision making discussed later.) Further the analysis of inputs, processes, and outputs provides a comprehensive set of data to be accummulated in MIS for reporting, analysis, simulation modeling, and varied research and decision making uses. The review of the input and output categories usually identifies few data elements that are not already collected either by the college or support unit (admission, student affairs, financial or faculty records). However, the evaluation of effectiveness and relation of information to decision making (discussed later) will suggest new input and output characteristics or data elements to be collected and new forms of analysis and reporting. Fianlly, the monitoring

of processes may suggest new categories or types of data - student faculty interaction patterns, amount of students or faculty time spent on various activities, and the like to be collected in MIS.

C. The Decision Making Process

While defining the basic structural units allows the identification of goals, inputs, processes, and outputs which need to be monitored (data input) and reported by the MIS, there is one further formal organization dimension that serves to clarify the reporting system designed for an MIS; namely, the decision making process. The major concern is with the type of decisions which must be made if the organization is to operate effectively (a topic which will be discussed later).

A typology of decisions suggested by Robert Anthony in his book Planning and Control Systems provides a useful framework for relating decision making to both organizational needs and information requirements.[7] The following chart summarizes his analysis:

Chart V

MIS	Type of Decision	Organizational Needs
Data and Reporting Formats →	Control	Survival and regularity
Data and Reporting Formats →	Managerial or Evaluative	Effective goal achievement
Data and Reporting Formats →	Planning	Reordering of goals and long term success

In order to survive any organization needs to control its day-to-day operations; i.e., assure that required tasks are carried out according to schedule and within the limitation of the resources allotted. Clearly in a university, such short term decision making information needs are met by the annual budgeting process, monthly fiscal reports, registration procedures, recruitment and hiring or admissions process reports, and the like. The basic concern of control reports is to provide information to decision making groups to insure that the department, college, or university is operating at the level projected and within the resources allotted. The information needed for such decision making is relatively straight forward and related to short term goals. The analysis for reporting requires little more than descriptive tabulation of data into succinct and comprehensible reports.

In a longer range sense, an organization needs to know if its longer range goals are being achieved and if its resources are being utilized effectively. The assessment of goals in a university as noted earlier is not a simple task and requires stating goals appropriately so that the MIS data elements required can be identified. More importantly, the data analysis and reporting schemes are much more complex and less standardized across university subunits. Differing subunit goals require differing analyses for managerial assessment of goal achievement. Further, the data analysis involves utilization of financial analysis techniques, cost benefit analysis, and analysis of qualitative as well as quantitative variables. This area is obviously one in which universities are still feeling their way but the decision making area is of prime importance to the development of an effective MIS.

The final decision category, planning, involves decisions that affect the ability of the university to adapt to future contingencies and to succeed (by some standard) in the long run. Planning involves the development of new goals or the reordering of their priorities, the identification of alternative programs for achieving them, and evaluation of long term success. Such activities and decisions require more comparative information about other universities or their comparable subunits and data on significant trends both within and without the university. The analytic techniques are more complex. Forecasting models, simulation models for assessing program decision alternatives, and the like are potential techniques which can be utilized. The university MIS developed to serve this level of decision making has to have not only a comprehensive data base and a highly sophisticated team of information systems analysts but also must be closely related to a capable group of research personnel.

Thus, the type of decisions serviced by an MIS at both the university and its subunit levels has extensive implications for the type of data collected, the reporting system, and the type of personnel required by the MIS unit.

D. The Effectiveness Dilemma

The question of what constitutes university effectiveness is not one to be resolved in this brief discussion. Are improved GRE scores a fair reflection of effective teaching? What is a good measure of research quality? Rather the purpose is to suggest briefly, that universities and their subunits, both educational and support units, should utilize a broader range of effectiveness measures than just direct productivity since other measures may be related to productivity directly or indirectly over the long run.

"Productive measures" in higher education (assessment of the productive function) are usually stated in terms of quantity, number of students, degrees, credit hours, research or scholarly publications, available computer time, and only occasionally in qualitative terms: achievement scores, quality of past university activity, prestigious image of the product. Relationships of these productive outputs to faculty time (S/F ratios), financial resources (cost per student credit hour, cost per computer minute, etc.) and other resource utilization ratios are generally viewed as managerial effectiveness measures. These, however, are subject to substantial controversy regarding which measures are appropriate--especially in the area of qualitative assessment of teaching, research, or service products. Again, the best measures of quantity or quality have to be agreed upon by each support unit, department, college, or university, and will be continuously refined as our analytic techniques become more sophisticated. The point to be made is that qualitative measures of productivity and measures not directly related to the productive functions of teaching, research, and service that should be utilized in evaluating a university or its subunits' effectiveness.[8] In terms of the model discussed in Chart III the other organizational functions to be evaluated are maintenance, boundary, managerial, and adaptive.

The "maintenance" function, the goodness of fit between the skills, motivations, and expectations of individuals and the colleges or universities demands or contraints, has been evaluated occasionally in higher education and extensively in other types of organizations. Some measures are student, faculty, and administrator morale, satisfaction with various aspects of their situation, evaluation of opportunities for their growth and

development, commitment and/or loyalty to the university (or subunit), and even the more tangible measures of faculty turnover and student drop out rates. The relationships between these measures and actual productive measures is often indirect yet it may highlight serious potential problems. For instance, poor faculty morale in the long run can lead to difficulty in recruitment, lower faculty quality, and less able students. Dropouts of significant numbers or the most able students has recently received considerable attention and the longer range implications for curriculum are more obvious. Thus, evaluation of maintenance function measures can identify potentially significant problem areas and suggests new types of data input and analysis and reporting formats for a university MIS.

The evaluation of the boundary functions,"production supportive" and "institutional supportive," again carries implications for a university's capacity to continue its productive activities effectively.* In the "production supportive boundary" function a monitoring of the qualities and characteristics of student and faculty inputs indicates the effectiveness of recruiting and selection. Also unusual changes in input patterns, either by shift in external demand (as for certain types of program) or by changes of university policy (disadvantaged admissions), can be assessed for

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*Two types of activities are classified as having boundary functions. Production supportive activities are those concerned with obtaining fiscal and human resources necessary for the major productive activities and those concerned with exporting the institution's product. Institutional supportive activities are those concerned with maintaining the organization's reputation with external constituencies. (Examples of the former are admissions, faculty recruiting, etc.; of the latter are public relations programs, maintaining ties with professional associations, agencies and other influential groups.

implications on the teaching, research, and service function. Naturally success in obtaining other inputs, such as financial or physical resources and success in disseminating the university's product such as the placement of graduates or publication of research and other boundary measures also need to be considered. The "institutional boundary supportive" function requires less obvious and more subtle measures. The concern is to assess the image of the university among its external constituencies: governmental, foundation, association, the public, etc. The measures vary from survey data, to evaluation of funding patterns, to success in accreditation, and often require long term trend or comparative data with other institutions for any evaluation. The importance of assessing or evaluating this university function needs little elaboration in today's turbulent academic world. However, the boundary productive and boundary institutional functions obviously need the support of an MIS system which has appropriate data sources and reporting formats.

The evaluation of the "managerial" function is really an overall assessment of how well the other functions are carried out. Yet, specific attempts to monitor the effectiveness of resource allocation and the success of program decisions in light of plans and objectives constitute more direct measures of managerial effectiveness. These issues have been referred to earlier and are an area of continuing debate and concern to university administrators as program budgeting formats are instituted, and as new mechanisms for economic and cost benefit analysis are assessed.

The final functional area which needs evaluation and one of the most difficult is the "adaptive" area. The evaluation of an institution's capacity to innovate, to respond and adjust to new inputs or external demands

and constraints, to control where possible elements in the external environment requires long term research and evaluation projects encompassing the assessment over time of goal achievement, goal appropriateness, and relative success compared to other institutions. Yet even more short range measures such as the amount of flexible funds for curricular or other kinds of innovation, the attitude of faculty and administration toward new projects, the capacity of the decision making process to eliminate obsolete as well as to add new programs and to respond quickly to crisis situations are examples of adaptability that can be observed. Thus, even adaptive behavior at the organizational level can be evaluated and requires appropriate data collection and analysis.

Perhaps it should be noted in closing this discussion of effectiveness that the author does not expect the MIS group necessarily to perform the evaluation of effectiveness task, to collect all of the data required, nor to do all the associated research. It does, however, assume that such evaluation ought to be anticipated in the design of the MIS system, and, where the evaluation is to be performed on a regular basis (perhaps annually or more often), attention needs to be given to incorporating the requisite data collection, analysis, and reporting format into the MIS system.

IV.

THE MIS - SOCIAL ORGANIZATION INTERFACE

It has already been suggested that an MIS system which is to be effectively designed and administered, viewed as legitimate by the members of the university community, and effectively utilized in the actual administrative operation needs to recognize many of the informal patterns or social organization of the particular university in which it is located.

The following issues delimit some of the major areas in which the "fit" of the new technological system with the informal pattern of university life needs to be reviewed for implications.

A. Decentralization - A Dilemma

Every MIS system designer strives for some degree of regularity and consistency in the definition of data inputs and reporting formats so that his system can function smoothly and at lower cost. Assuming that data input is defined and regularized after analysis of the formal organization patterns previously discussed, the problem of relating the reporting format to the real decision making pattern of the university (control, management, and planning decisions previously discussed) is only partially solved. Anyone familiar with most universities is aware that major decisions may be made not only at different organizational levels within the various colleges but also at differing levels among departments or other subunits within the colleges. Further, the formal authority for decision making on various key decisions is often only vaguely defined and in practice seldom followed. Thus, analysis of the formal decision authority pattern (charter, by laws, etc.) can lead to the development of a reporting system which fails to get the appropriate information to the level where decisions are made.

The dilemma is clear. To insure informed decisions, MIS needs to report the appropriate information at the level where decisions are made, and yet the variability of the decision making pattern in actual practice may make this impossible or very expensive. The answers are not easy but implied approaches are clear. The design of an MIS (especially the reporting side) needs to be related to a clear analysis of where decisions on

key issues such as budget allocation, personnel policies, curricular and academic program policies, and the like are made. While the role of MIS is not to redefine the way decisions are made, such an analysis, closely coordinated with the administration and faculty of the schools and colleges should provide some clarification and agreement on decision levels at least within those major units if not among them. The current concerns of faculty and students to participate to a greater extent in decision making and their frustration at not being able to identify decision making points might be a strong force favoring such clarification.

B. Participation and Influence

Closely related to the decentralization dilemma are the questions of who shall participate in decision making? and how much influence will each group or organization level have in each decision? Again, no answers are clearly indicated, and each campus must seek its own accommodation; however, the implications for MIS seem clear.

As varying groups of students, faculty, and even staff are allowed to participate (usually informally at first, and later, formally), the tendency is to move from a closed to an open information system; i.e., from one in which reports are confidentially made to key administrators and much of the MIS data bank's information is available only to them to a system in which many individuals and groups have access to most of the administrative reports and data files. In one sense, this merely means more detailed work for the MIS group; preparing more copies of reports, answering more requests for data, and the like. At a more sensitive level, the MIS staff's relationship to its users will probably change. Rather than serving administrators

who are accustomed to financial statements and complex reports based on specifically defined data elements, a much less sophisticated clientele not familiar with the terminology of full time equivalent student counts, budget categories, and other complexities must be served. The situation will require greater MIS staff effort to simplify and clarify reporting statements and to provide greater assistance to users in understanding and interpreting the data provided. A final implication of wider participation is the accentuated rate of self generation of an MIS (a previous assumption). It seems logical to conclude that reports to administrators whose tenure in decision making bodies and manner of approaching problems is relatively stable and who are under tremendous pressures of day-to-day conflicts and operational detail are unlikely to generate a great volume of new questions needing new data collection, analyses, and/or reporting formats. However, the fresh review of information by student and faculty groups whose rate of rotation in decision making groups is higher and whose perspectives are very different from administrators is likely to generate many new questions requiring data. Thus, widened participation could place the MIS system under greater pressures to provide their service. This will be especially true in the early stages of its development in which difficult questions of priorities for MIS development and policies for its operation need to be formulated.

Closely related to participation is the question of influence or who has greatest impact on decision making? As new groups participate and new governance mechanisms are created (university senates, student judiciaries), the level of decision making may often shift both horizontally and

vertically. Thus, the attempt to relate MIS to the decision making pattern (the decentralization issue) becomes more difficult and makes it imperative that the MIS reporting system be continuously open to revision to take into account these new patterns of participation and influence.

C. Communications Impact

As an oft studied variable in organizational literature, many dimensions of communications have been found to affect the organization's performance. In a university one aspect of communication that would appear to be greatly affected by the development of MIS is the notion of overload.[9] A complaint often voiced by college and university administrators--department chairmen, directors, deans, executive officers--is the tremendously long hours and overabundance of paper work which characterizes their work. Thus, the development of MIS may be viewed as just increased paperwork and reports flowing through the office. This problem may be averted if MIS designers follow some explicit guidelines: first, administrators should be involved in designing the MIS data collection and reporting system for their unit to insure that they are related to decision problems and are intelligible to the user; second, the design of MIS reporting formats should be concerned with eliminating and/or incorporating existing reports received by the administrator into any new ones devised--the possibility of reducing his information overload may even exist; and third, the MIS group should be flexible and responsive to the administrator's needs for new information and for training sessions for his staff so that the burden of translating information into decision making analysis does not rest entirely with the user unit.

D. The Norm of Confidentiality

Along with our changing patterns of university governance, there has arisen an increased concern for the confidentiality of data kept about individual students, faculty, and administrators. In addition to the concerns of members of the university community about the maintenance of personal but factual information (political affiliation, past social associations, criminal records, etc.), there is increasing judicial concern about the nature of judgmental information that can or should be kept in a person's confidential file. This is confounded by frequent disagreements regarding who has access to whose file (or portions) and under what circumstances. In light of this sensitive situation MIS design of individual data files requires concern about three matters: first, it is necessary to ascertain that information kept on individuals is legal; second, in the case of legal but controversial information, a procedure needs to be established to ensure that appropriate consideration is given to all interested parties and that a policy regarding the collection and dissemination of such information is firmly established; and finally, once information of a personal nature is collected, adequate safeguards on its availability and retrievability need to be established. It goes without saying that the verification of accuracy of such information is of primary importance.

E. Accommodation of Diverse Norms

This discussion of the relationship of MIS to the social organization highlights one of the greatest difficulties for MIS designers. Not only are the norms and attitudes of groups in the university diverse--but often in direct conflict. Further, some of the most prevalent norms are often in

conflict. This places the designer of an MIS system in a sensitive position.

For instance, the desire for greater participation and influence seems to suggest more open information and reporting systems. Yet the norm of confidentiality suggests that certain data should be closely guarded (or not collected at all). Also, the MIS director who openly distributes information may be welcomed by those who desire more power and influence but decried by those who are trying to guard power that is the result of their privileged access to information such as the budget or personal files.

In other instances some faculty and administrators may ascribe to a norm of "rationality" and favor the collection of increased amounts of information and analysis of university operations while others will view it as an infringement on their highly guarded "autonomy" or even "academic freedom." At times groups may seek information as a way of highlighting problems which can become political or devisive issues while other groups will seek it as a mechanism for obtaining greater agreement and consensus. The development of MIS cannot escape the conflict of these diverse norms and changing patterns of behavior by the various university members.

The only implications from this final analysis of the MIS ial organization interface are trite yet worth repeating. Because diverse groups and norms have to be accommodated for MIS to be effectively implemented and utilized, a wide range of university constituencies need to be involved in its inception, in the establishment of policies and procedures for data collection, reporting, availability, and priority of development, and in its continued operation. The MIS Director and some

of his staff should be persons experienced in higher educational organizations and aware of the sensitive issues with which they are dealing. And finally, a decision to institute MIS needs to have a broad base of support especially among the executive and academic officers of the institution. The difficulties to be encountered in the development and implementation of an MIS system, as this analysis suggests, will have far reaching effects. Thus, the executive officers, faculty advisory groups, and administrative staff need to be aware of the problems to be encountered and committed to developing a workable and flexible system not the perfect system.

V.

MIS AND THE EXTERNAL ENVIRONMENT

The development of this technical subsystem is not merely influenced by internal university concerns but also by factors in its external environment. Demands for reports by coordinating boards, state and federal government agencies, foundations, accrediting agencies all need to be heeded if the support of funding sources are to be maintained, the fiduciary and legal responsibilities of the university carried out, and the desire for academic respectability is to be achieved. The various external agencies and their requirements will not be highlighted but the extensive requirements on MIS design both in terms of analysis, reporting formats, retrievability, and data collection should be obvious.

Several developments may serve to simplify the university's attempt to respond to these information demands. The Higher Education General Information System (HEGIS) project of USOE is an attempt to standardize and centralize many of the report formats or data element definitions required by varied governmental agencies. In a related effort the WICHE PMS project

(formerly MIS) is being followed closely by many institutions and state agencies and could provide more standardized data element definitions, program classification categories, and, eventually, formats for comparative analysis between higher educational institutions.[10]

The constraints and data demands of external agencies is generally recognized by those designing MIS systems (often it is the major motivating factor behind executive officers' support). What is often overlooked is the fact that an MIS system which attempts to serve the decision making categories of managerial evaluation and planning, requires new data sources external to the university. For example, forecasting enrollment trends, curricular demands and the like requires data elements whose sources are external to the university--data on population, financial support, cost of living, growth of competing institutions, and other trends. Thus, new kinds of external trend data are required regularly.

If deans or department chairmen are to evaluate their respective schools and departments, comparative data from other similar institutions may be one of the best available criteria. Obviously the cost patterns of schools of medicine are very different from business schools. Attempts in the CIC, by state agencies, and other cooperative groups may limit the amount of effort an MIS group does in this area. However, comparative data in other institutions should be easily available from some source.

If universities become concerned with long range product performance (how have our students done after graduation) and boundary effectiveness measures, new and creative means for collecting data from external sources need to be considered. How does one keep up with alumni and assess their

performance? How good is our image among external constituencies such as the public, the legislature, the higher education group to which we aspire. Again, the MIS system may not find it possible or necessary to regularly collect data of this type, but the possibility should be evaluated.

The final issue of the MIS-Environment relationship is the political meaning of MIS. What is the impact of tremendous amounts of data which, no doubt, will become more and more public? Will legislators use it for political purposes or can the university use it to argue for more rational appropriation levels? The answers are not easy. There is little doubt that universities need better information if they are to convince external bodies they are well managed. But the demands of legislatures, and other funding agencies, the nature of the state coordinating agencies and other such groups probably make MIS development inevitable. In considering the external environment, the role of those involved in MIS design, then, is to present data in forms which has the greatest potential for rational discussion rather than political debate, to consider carefully the collection of data which might be controversial or damaging to the individual or the institution, and to assure that the external groups are educated as to the nature of university operations which are highlighted by the external reports.

VI.

MIS - AN ORGANIZATIONAL FORMAT

A final question which needs to be raised regards the location of MIS within the university. This is not easily analyzed for MIS, in this discussion, has been treated as a very vaguely defined organizational process with appropriate staffing. However, several points which follow from the previous discussion would suggest certain linkages that are important.

First, MIS is not an isolated staff group. It collects data from and makes it available to most all educational and support units of the university. The data collected and reporting formats will, of necessity, change quite often. It would seem, therefore, that each major unit (a college, the library, student personnel office, etc.) should have a staff member who was intimately acquainted with the MIS staff, its technology, and operations. This would assure a smoother working relationship between the MIS staff and the various user units serviced by MIS.

Second, it has not been assumed that the MIS group would do all the financial analysis, space analysis, institutional research, instructional research, and the like normally done by specialized staff groups. However, since it will store much of the data used by those groups, there needs to be a close liaison between them and the MIS group. One might consider placing all data analysis and university focused research groups under the same executive officer as the MIS group; however, in light of the special tasks of some such groups (as in instructional research) this much centralization might divert them from their central task.

Third, in light of the potentially sensitive or controversial nature of much of the MIS operation, it would seem necessary to have some policy board to whom MIS could turn for guidance on controversial issues. This might be a university executive committee or other special body. However, in view of this author's preference for keeping the focus of MIS on serving educational as well as business operational objectives of the university, such a policy board, probably should have a substantial number of academic administrators or faculty members on it.

Fourth, in view of the concern for relating MIS to higher levels of decision making (managerial evaluation and planning), one approach is to raise the planning function to vice presidential status. Such an officer can coordinate academic fiscal, and physical planning and might have the MIS group as a major support staff for his unit. Such an approach is being tried at certain large universities. This approach assumes, not very accurately for many universities, that the basic data elements for operational control are already relatively well defined and that the developments of MIS will be in the area of improved data collection and reporting for evaluation and planning decisions.

While many other organizational questions might be raised about the location of MIS (centralized vs. decentralized, etc.), these are beyond the purview of this paper. The points raised in this discussion essentially assume that the precise location of MIS is not as important as the extent to which it is effectively coordinated with the user units and the degree to which it operates as a unit which enhances the university's adaptive capacity.

Summary

This chapter has analyzed the interrelationship of a Management Information System with various aspects of the university's formal and social organizational pattern and its ties with the external world. Implications were discussed which affect both the data collection and the analysis and reporting segments of the MIS process (See Chart VI). An assumption has been made that, to the extent that the information is useful in decision making or evaluating effectiveness and its collection can be justified on a regular basis, it is part of the MIS process. Thus, the distinction of

hard and soft data is not made. Soft data (attitudes, personality data, etc.) is presumed to be just as integral a part of the total MIS as hard data if it can be utilized to make better decisions about day to day control, managerial evaluation, or planning. Similarly, the discussion assumes that data relevant to several functional outcomes, and not just the productive function, will be collected.

The analysis points out the extent to which an MIS design needs to consider the nature of the university in which it is placed, some of the critical problems for implementing and for obtaining acceptance and utilization of the MIS, and some of the difficult issues and organizational questions with which a university's executive officers and the MIS Director must struggle to implement an effective total management information system.

Chart VI

Relationship of Organizational Variables Discussed
To Segments of the MIS Process

MIS Data Elements Affected	Organizational Variable	MIS Analytic or Reporting Format Affected
	Formal Organization:	
?	Goals	Yes
	Structure:	
Yes	Inputs, process, outputs	Yes
	Decision Making Process:	
Yes	Control	Yes
Yes	Managerial Evaluation	Yes
Yes	Planning	Yes
	Effectiveness by Function:	
Yes	Productive	Yes
Yes	Managerial	Yes
Yes	Maintenance	Yes
Yes	Boundary	Yes
Yes	Adaptive	Yes
	Social Organization:	
?	Decentralization	Yes
Yes	Participation and Influence	Yes
?	Communications	Yes
Yes	Confidentiality	Yes
?	Accommodation of Norms	Yes
	External Environment:	
Yes	Groups Demands and Constraints	Yes
Yes	Comparative Data for Evaluation	Yes
Yes	Trend Data for Planning	Yes
Yes	Long Range External Performance Measure	Yes

Footnotes

1. Boguslaw, Robert, The New Utopians. Prentice-Hall, 1965, p. 2.

2. For further discussion of these functions see: Katz, Daniel and Robert Kahn, The Social Psychology of Organizations. John Wiley, 1966, especially Chapter 2.

3. For more detailed models that attempt to define data elements, data files and subsystems, and the simulations of their interrelationship, the reader is referred to works listed in the bibliography by Keeney, Koenig, and Zemach; Judy-Levine; Minter and Lawrence; or Johnson and Katzenmeyer.

4. For discussion of these organizational subsystems see: Seiler, John, Systems Analysis In Organizational Behavior. Irwin-Dorsey, 1967.

5. For discussion of dimensions of goals see: Warner, W., and A. Havens, "Goal Displacement and Intangibility of Organizational Goals." Administrative Science Quarterly, March, 1968, pp. 539-555.

6. Gross, E., and P. Grambsch, University Goals and Academic Power. American Council on Education, 1968, Chapter 1.

7. Anthony, Robert, Planning and Control Systems. Graduate School of Business Administration, Harvard University, 1965. Chapter 1.

8. For discussion of varied effectiveness measures see: Price, James, Organizational Effectiveness. Irwin-Dorsey, 1968, or Seasnore, S., and E. Yuchtman, "Functional Analysis of Organizational Performance," Administrative Science Quarterly, December, 1967, pp. 377-395.

9. For an example of a communications overload study in a university setting see: Meier, R., "Communications Overload," Administrative Science Quarterly, March, 1963, pp. 521-544.

10. For a discussion of the HEGIS and WICHE projects see: Johnson, C., and W. Katzenmeyer, Management Information Systems in Higher Education: The State of the Art. Duke University Press, 1969, Chapters 5 and 6.

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